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GEOMETRY.

420. Proposed by C. N. SCHMALL, New York City.

Four spheres are described so that each touches a face of a given triangular pyramid and the other three faces produced. If the radii of the escribed spheres be r_1, r_2, r_3, r_4, and r be the radius of the inscribed sphere, show that

$$\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}+\frac{1}{r_4}=\frac{2}{r}.$$

421. Proposed by R. P. BUSSEY, University of Iowa.

Assuming the details of the proof of the existence of a sphere inscribed in a tetrahedron as usual in the texts, give an intuitional proof that there are in general eight spheres each touching the four faces, but for the regular tetrahedron only five. How many special types are there?

422. Proposed by J. SCHEFFER, Hagerstown, Md.

Construct strictly by use of elementary plane geometry, a triangle having given the product of two sides, the median to the third side, and the difference of the angles adjacent to the third side.

423. Proposed by C. N. SCHMALL, New York City.

The sum of the squares of the distances of a point from n fixed points is constant. Show that the locus of the point is a circle.

CALCULUS.

342. Proposed by CLARIBEL KENDALL, University of Colorado.

Referring to Poincaré's *Science and Hypothesis*, page 65, show that the path between two points, in Poincaré's ideal world, requiring the least number of steps of beings such as exist on earth, is the arc of a circle cutting the boundary of the Poincaré world orthogonally.

343. Proposed by C. N. SCHMALL, New York City.

Show that the envelope of the system of circles, whose radii are the ordinates of an ellipse, is a concentric ellipse having the same minor axis as the given ellipse. Does this ellipse touch all the circles of the system?

344. Proposed by B. F. FINKEL, Drury College.

Solve the differential equation,

$$\frac{d^2y}{dx^2}(a^2-x^2-y^2)=\left(x\frac{dy}{ds}-y\frac{dx}{ds}\right)\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}.$$

337. *Correction.* For $\int_0^1(\cos 2\pi ax+\cos 2\pi bx)dx$ read $\int_0^1|\cos 2\pi ax+\cos 2\pi bx|\,dx$.

MECHANICS.

273. Proposed by A. M. HARDING, University of Arkansas.

A spherical shell of mass m explodes when moving with negligible velocity at a height of h feet above the ground. The shell is divided into very small particles, each of which moves, after the explosion, away from the center of the shell with a velocity v, and ultimately falls to the ground. Find the total mass of the fragments which will be found per unit area at any specified distance from the point vertically underneath the shell.

274. Proposed by W. W. LANDIS, Dickinson College.

A dam backs up the water for two miles. If the dam is raised 18 inches, will the water two miles up the stream be raised 18 inches, more or less?

NUMBER THEORY AND DIOPHANTINE ANALYSIS.

190. Proposed by L. E. DICKSON, University of Chicago.

Find two numbers a and b each of two digits such that, when the product ab is found by the usual method, the two partial products to be added are exactly the same as the partial products in getting the product ba. Is there a similar pair of numbers of three digits?